range from $13 per cubic yard to $34 per cubic yard, excavation costs excluded.

- **Technology Evaluation.** On site disposal is a viable and implementable technology. Since soils/sediments potentially requiring removal contain common constituents of interest, excavated material can be disposed of in a single location. Additional cost savings are realized with this option in terms of comparison to transportation and off site disposal fees associated with the off site disposal technology. On site disposal could occur at the existing landfill, Area A, or could occur at a different on site location. However, use of an on-site location other than Area A may require the permitting, design, construction, and operation and maintenance of a fully-permitted solid waste landfill. The cost of such a facility could be prohibitive. As previously discussed, a cap/cover system is an acceptable alternative for the prevention of constituent transport and/or migration due to erosion, run-off, or incident precipitation. As such, this technology meets all corrective measure objectives and, therefore, will be considered in the detailed analysis as a component of the corrective measure alternatives analysis.

4.4 TECHNOLOGY EVALUATION BY SITE AREA AND ASSEMBLY OF ALTERNATIVES

Preliminary screening has resulted in the selection of applicable technologies which will now be evaluated against each particular site area of interest as identified in Section 3. Sitewide corrective action alternatives will be assembled as a result of this analysis. A summary of site area factors relevant to technology selection is presented below and summarized in Table 4-5. The closed landfill, Area A, has been previously provided with a clay cap and was covered with additional top soil with seeding in the fall of 1991. Therefore, a discussion of Area A is presented only to the extent that it affects criteria evaluation of other site areas. Sludge from the five wastewater ponds (Area E) has been sampled in the past and determined to be nonhazardous. In addition, the ponds have always been periodically dredged and the sludge disposed in a permitted off site landfill. This dredging was last performed in 1991. Further, cadmium, one of the constituents detected in the sludge, was removed from the process wastewater by RMI in 1989. Therefore, the

TABLE 4-5

CORRECTIVE MEASURE TECHNOLOGY - SITE AREA MATRIX

RMI SODIUM FACILITY
ASHTABULA, OHIO

Technology	Area B	Area C	Area D	Area F	Area G
No Further Action	Relatively high Cd and Pb levels. Small volume. Pb concentration >1 order of magnitude above action level.	Small volume. Low concentrations.	Relatively low levels. Only 1 constituent (Pb). Already covered. Difficult excavation. "Significant" volume.	Relatively small volume. Relatively low concentrations.	Relatively low levels & small volume-surficial; higher levels in subsurface. Significant volume. RMI may want to locate manufacturing facilities here.
Institutional Controls	See No Further Action.	See No Further Action.	See No Further Action.	See No Further Action.	See No Further Action.
Capping/Covering/ Surface Controls	Surficial contamination. Relatively high concentrations.	Surficial contamination. Low concentrations.	Low concentrations. Significant area. "Clean" soil cover already exists.	Low concentrations. Surficial contamination. Associated rise in topography may interfere with potential future site use.	Significant area. Surficial and subsurface contamination. Associated rise in topography may interfere with potential future site use.
Excavation	Small volume.	Small volume. Low concentrations.	Significant volume. Low concentrations. Difficult excavation. Possible utility conflicts and/or disruption in service.	Small volume. Relatively low concentrations.	Small surficial volume; large subsurface volume. Only Pb w/relatively high concentration (in the subsurface). See No Further Action. Potential utility conflicts.

TABLE 4-5 (Continued)

CORRECTIVE MEASURE TECHNOLOGY - SITE AREA MATRIX

RMI SODIUM FACILITY
ASHTABULA, OHIO

Technology	Area B	Area C	Area D	Area F	Area G
Treatment	May be worthy of consideration due to concentration of Pb.	Low concentrations. Small volume.	Low concentrations. Significant volume.	Relatively low concentrations. Relatively small volume.	Large volumes. Only Pb concentration may warrant it.
Off Site Disposal	Relatively high concentrations.	See On Site Disposal.	See On Site Disposal.	See On Site Disposal.	See On Site Disposal.
On Site Disposal	Small volume. Relatively high concentrations.	Small volume. Low concentrations.	Significant volume. Low concentrations.	Small volume. Relatively low concentrations.	Low to relatively high concentrations. Large subsurface volume.

ponds no longer act as a potential recharge source for constituents of interest at the site, but they still serve as an important hydrogeologic barrier to acidic groundwater from off site. RMI recognizes the importance of maintaining this barrier. As such, the water levels in the ponds have been (and will continue to be) maintained by RMI at levels similar to those of the past. Because corrective measures have effectively already been implemented at the ponds, a discussion of the ponds is presented only to the extent that they may be affected by evaluation of other areas and other corrective measures. Estimated volumes for the remaining SWMUs were then calculated based on comparison to the action levels, as presented in Section 3.1. For each SWMU, the specific medium and constituents of interest for which average measured levels exceeded the USEPA action levels were summarized and are presented in Table 4-6.

Physical characteristics of site areas, including estimated surface areas and volumes, are also summarized in Table 4-6. The area boundaries have been established based upon historical aerial photographs, known areas of surficial storage, as well as existing physical boundaries, such as buildings, drainage ditches, service facilities, and asphalt access roads which act as adequate cover/containment and preclude the need for excavation of material potentially existing below them. Based on this information, the boundaries of Areas A, B, C, D, E, F, and G depicted in Figure 1-1 have been adjusted outward slightly, circumscribing the maximum lateral extent of remedial action. The revised areas, which are listed on Table 4-6 and are depicted in Figure 3-2, more accurately reflect the focus and implementation of proposed corrective measures.

The approximate vertical extent of constituent presence shown on Table 4-6 is based on depth intervals for samples that exceeded the USEPA action levels. This approximate extent was then conservatively rounded up in most cases to represent the depth of excavation/treatment. Estimated volumes shown in Table 4-6 are represented by the depth of excavation/treatment and the boundaries of waste placement defined by the delineation of each SWMU. Estimates of potential soil volumes to be remediated were then calculated by multiplying the adjusted lateral and vertical extents of constituent presence. Additional comparisons were made between the ranges of constituent concentrations for each individual area against the range of background concentrations and action levels. The results of this

TABLE 4-6

SITE AREA DIMENSIONAL AND CONSTITUENT DATA

RMI SODIUM FACILITY
ASHTABULA, OHIO

Area Designation	Medium	Constituent(s) of Interest	Measured Level[a]	USEPA Action Level[a]	Area (Sq Ft)	Area (Ac)	Approximate Vertical Extent of Constituent Presence (Ft)	Depth of Excavation/ Treatment (Ft)	Estimated Volume (CF)	Estimated Volume (CY)
B & C	Area B Surficial Soils	Cd Pb As	199 355 18.4	40 24.9 12	73,300	1.68	0-0.33	0.5	36,650	1,357[b]
	Area B Drainage Ditch Surface Water	Cd	37.9 ppb (DW-B)	9.5 ppb						
	Area C Surficial Soils	Pb As	80.7 21.7	24.9 12						
D	Shallow Soils	Pb	37.4	29.9	8,130	0.19	3-6.5	6.5	52,845	1,957
F_1					5,730	0.13	0-0.5	0.5	2,865	106
F_2					2,100	0.05	0-0.5	0.5	1,050	39
F_3					14,170	0.33	0-0.5	0.5	7,085	262
F_4					17,000	0.39	0-0.5	0.5	8,500	315
F_5					1130	0.03	0-0.5	0.5	565	21
$F_{total\ (1-5)}$	Surficial Soils	Pb As	87.5 17.6	25.9 12	40,130	0.93	0-0.5	0.5	20,065	743
G	Surficial Soils	As Pb	18.5 29.1	12 24.9	50,000	1.15	0-0.5			
	Shallow Soils	Cd Pb	85.2 189.9	40 29.9	50,000	1.15	0.5-3.3			
G_{total}	Shallow Soils				50,000	1.15		3.5	175,000	6,482
Project Totals	(B + C + D + F + G)				171,560	3.94			284,560	10,539
	(B + C + F + G)				163,430	3.75			231,715	8,582
	(B + C + F)				113,430	2.60			56,715	2,100
	(B + C + G)				123,300	2.83			211,650	7,839

[a]Concentrations in ppm unless otherwise noted.
[b]Includes approximately 100 cu yd of sediment from ditch immediately east of Area B.

comparison show that the areal and vertical extent reflected in Table 4-6 which define the volume of soil to be remediated is currently being addressed.

Areas B and C were used as a storage area for dismantled sodium cell components which were temporarily off line. Areas B and C have been grouped together for study purposes due to the close proximity of the two areas and similar constituent characteristics. Concentrations of constituents are relatively low in Areas B and C, with the exception of the presence of Pb in Area B, which is observed in concentrations of more than an order of magnitude larger than the proposed action level of 24.9 ppm. In summary, both Pb and As are present in Areas B and C, while Area B and the adjacent drainage ditch also display an observance of Cd. The Baseline Risk Assessment (Appendix A) shows that the estimated hazard index for Area B surficial soils (1.7) exceeds the USEPA acceptable level of 1.0 for the speculative future residential development scenario. The combined area is 1.68 acres and constituents of interest are present to a depth of 4 inches. Using a practical excavation depth of 6 inches, the resulting excavation volume is approximately 36,650 cubic feet (1,357 cubic yards).

Due to the relatively small volumes and shallow constituent source zone depths, this area is highly amenable to either excavation and backfill, or capping/covering. Disposal options suitable for this material include either on site Area A or Area G or transportation to an off site facility. Capping options for this area include topsoil and surface vegetation, soil cover system with a final vegetative cover, or installation of a geomembrane cover system.

Area D comprises approximately 0.19 acres and is located at the southeast corner of the wastewater treatment ponds on the eastern edge of the facility. The area slopes upwards from existing grade to Pond 2 and is presently grassed. Known utilities in the area include aboveground electrical service and a below grade pond water french drain system. The findings of the RFI indicate that Area D exhibits Pb concentrations (37.4 ppm) slightly above the action levels (29.9 ppm) at depths beginning at 3.0 feet and continuing to 6.5 feet. The constituent source zone volume is estimated to be 28,455 cubic feet (1,054 cubic yards); the excavated depth, however, would involve an estimated 52,845 cubic feet (1,957 cubic yards).

Due to the existing 3 feet of soil cover over the constituent source zone and the presence of vital facility utilities in this area, the most cost effective remedial option (excluding no action) would be capping/covering. Excavation and on site disposal at Areas G or A, or off site disposal are also viable options and will be considered in the detailed analysis.

Area F consists of five distinct areas which are located in the northwest vicinity of the wastewater treatment facilities. The total surface area which comprises this unit is 0.93 acres and constituents of interest have been observed to a depth of 0.5 feet. The excavated volume of the constituent source zone, therefore, equals 20,065 cubic feet (743 cubic yards). The primary constituents of interest in Area F are Pb and As with observed concentrations of 87.5 ppm and 17.6 ppm, respectively. Action levels in these areas for Pb and As are 25.9 ppm and 12 ppm, respectively. Risk estimates for this area were all below or within acceptable USEPA levels.

Due to the relatively small volumes and shallow constituent source zone depths in this area, the most cost effective remedial options would be either excavation and backfill or capping/covering. Disposal locations which are suitable for this material include either on site Area A or G, or transportation to an off site facility. Capping options for this area include topsoil and surface vegetation, a soil cover system including a final topsoil and vegetative cover, or a geomembrane cover system and final topsoil and vegetative cover.

Area G is presently an undeveloped, gently sloping area at the northeast vicinity of the facility. RFI findings include constituents of interest As and Pb in the surficial soils at levels of 18.5 ppb and 29.1 ppm, respectively, and Cd and Pb to observed depths of 3.3 feet. The observed Cd and Pb concentrations in the shallow soils are 85.2 ppm and 189.9 ppm, respectively, while the action levels for this area have been set for Cd, Pb, and As at 40 ppm, 29.9 ppm, and 12.0 ppm, respectively. Risk estimates for surficial and subsurface soils in this area were all below or within acceptable USEPA levels. Excavation to 3.5 feet results in a constituent source zone volume of 175,000 cubic feet (6,482 cubic yards).

Because the total excavation estimated for Area G is relatively large (in comparison, it is greater than the combined estimated excavation volumes of Areas B, C, D, and F); and because the area is relatively flat and undeveloped, Area G presents itself as

a viable candidate for capping. Area G also lends itself readily to excavation and on site disposal at Area A or off site disposal in the event that RMI prefers the removal and consolidation of this material. Excavation may be hampered by underground utilities, including electrical conduit through the area, and quite possibly, storm sewer and cooling tower and raw water lines in the vicinity.

Evaluation of the potential corrective measure technologies reveals that the no further action, excavation, on site disposal, off site disposal, and capping/covering technologies apply to all areas of the facility. Based upon the findings of the HEA, constituents of interest are largely immobilized in the soil, which may render treatment by soil washing difficult and treatment by stabilization/solidification as providing marginal mobility decreases over present constituent mobility. Because treatment costs excessively add to excavation costs due to the small volumes of material, and do not provide a commensurate increase in health and environmental protection, treatment options will not be carried forward for detailed evaluation.

Ten proposed corrective measure alternatives have been assembled based upon the above evaluation and are presented in Table 4-7. These assembled alternatives will be carried forward for detailed analysis in Section 5.

TABLE 4-7

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
1	NO FURTHER ACTION • Continued maintenance of vegetation, stormwater management, and site security facilities.
2	LIMITED INSTITUTIONAL ACTION • Continued maintenance of vegetation, stormwater management, and site security facilities. • Record site use/development restrictions on property deed, including prohibiting excavations in any fill area. • Groundwater Monitoring
3	SOURCE CONTAINMENT • Leave existing topsoil and vegetative cover on A. • Modify surface water drainage patterns during and after construction. • Replace or restore topsoil cover and establish vegetative growth at Areas B, C, D, F, and G. • Record development/use restrictions on property deed. • Continued maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring
4	EXCAVATION / ON SITE DISPOSAL
4A	Excavation/On Site Disposal at Area A • Modify surface water drainage patterns and provide erosion control during and after construction.

TABLE 4-7 (Continued)

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
	• Strip clean topsoil and vegetation from Area A; stockpile topsoil, reuse for final vegetative layer. • Excavate and haul Areas B, C, D, F, and G and ditch segment adjacent to Area B on the east. • Place excavated material onto eastern one half of Area A. • Backfill excavated Areas D and G with clean fill to within 6 inches of surface. • Install cap over excavated material, addressing all obstructions. Option 1: 1 foot clay over excavated material 6 inches of new topsoil 6 inches of topsoil stockpiled from Area A Option 2: Synthetic liner over excavated material Composite synthetic drainage layer (geotextile fabric immediately above) 3.5 feet of clean soil 6 inches of topsoil stockpiled from Area A • Establish vegetation at Areas A, B, C, D, F and G. • Record development/use restrictions on property deed for Area A. • Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring
4B	Excavation/On Site Disposal at Area A; No Further Action at Area D. • Modify surface water drainage patterns and provide erosion control during and after construction. • Strip clean topsoil and vegetation from Area A; stockpile topsoil, reuse for final vegetative layer.

TABLE 4-7 (Continued)

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
	• Excavate and haul Areas B, C, F, and G and ditch segment adjacent to Area B on the east. • No Further Action at Area D. • Place excavated material onto eastern one half of Area A. • Backfill excavated Area G with clean fill to within 6 inches of surface. • Install cap over excavated material, addressing all obstructions. Option 1: 1 foot clay over excavated material 6 inches of new topsoil 6 inches of topsoil stockpiled from Area A Option 2: Synthetic liner over excavated material Composite synthetic drainage layer (geotextile fabric immediately above) 3.5 feet of clean soil 6 inches of topsoil stockpiled from Area A • Establish vegetation at Areas A, B, C, F, and G. • Record development/use restrictions on property deed for Area A. • Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring
4C	Excavation/On Site Disposal at Area G; No Further Action at Area D • Leave existing topsoil and vegetative cover on Area A. • Modify surface water drainage patterns and provide erosion control during and after construction. • Excavate and haul Areas B, C, and F and ditch segment adjacent to Area B on the east.

TABLE 4-7 (Continued)

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
	• No Further Action at Area D. • Place excavated material on Area G; spread in uniform layer across surface. • Install cap over excavated material, addressing all obstructions. Option 1: 1 foot clay over excavated material 12 inches of new topsoil Option 2: Synthetic liner over excavated material Composite synthetic drainage layer (geotextile fabric immediately above) 3.5 feet of clean soil 6 inches of topsoil • Establish vegetation at Areas B, C, F, and G. • Record development/use restrictions on property deed for Areas A and G. • Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring
4D	Excavation of Area F Only and On Site Disposal at Area G; Containment at Areas B, C, D, and G. • Leave existing topsoil and vegetative cover on Area A. • Modify surface water drainage patterns and provide erosion control during and after construction. • Excavate and haul Area F and ditch segment adjacent to Area B on the east. • Place excavated material at Area G; spread in uniform layer across surface. • Install cap over Areas B, C, D, and G, addressing all obstructions.

TABLE 4-7 (Continued)

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
	Option 1: 1 foot clay over excavated material 12 inches of new topsoil Option 2: Synthetic liner over excavated material Composite synthetic drainage layer (geotextile fabric immediately above) 3.5 feet of clean soil 6 inches of topsoil • Establish vegetation at Area F. • Record development/use restrictions on property deed for Areas A, B, C, D, and G. • Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring
4E	Excavation/On Site Disposal at Area A; No Further Action at Areas D and F. • Modify surface water drainage patterns and provide erosion control during and after construction. • Strip clean topsoil and vegetation from Area A; stockpile topsoil, reuse for final vegetative layer. • Excavate and haul Areas B, C, and G and ditch segment adjacent to Area B on the east. • No further action at Areas D and F. • Place excavated material onto eastern one half of Area A. • Backfill excavated Area G with clean fill to within 6 inches of surface. • Install cap over excavated material, addressing all obstructions.

TABLE 4-7 (Continued)

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
	Option 1: 1 foot clay over excavated material 6 inches of new topsoil 6 inches of topsoil stockpiled from Area A
	Option 2: Synthetic liner over excavated material Composite synthetic drainage layer (geotextile fabric immediately above) 3.5 feet of clean soil 6 inches of topsoil stockpiled from Area A.
	• Establish vegetation at Areas A, B, C, and G. • Record development/use restrictions on property deed for Area A. • Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring.
5	EXCAVATION / OFF SITE DISPOSAL
5A	Excavation/Off Site Disposal
	• Leave existing topsoil and vegetative cover on Area A. • Modify surface water drainage patterns and provide erosion control during and after construction. • Excavate Areas B, C, D, F, and G, and ditch segment adjacent to Area B on the east. • Transport and dispose excavated material at permitted off site facility. • Backfill excavated Areas D and G with clean fill to within 6 inches of surface. • Re-vegetate Areas B, C, D, F, and G.

TABLE 4-7 (Continued)

DESCRIPTION OF ASSEMBLED CORRECTIVE MEASURE ALTERNATIVES

RMI SODIUM FACILITY
ASHTABULA, OHIO

Alternative Number	Alternative Description
	• Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring.
5B	Excavation/Off Site Disposal; No Further Action at Areas D and F.
	• Leave existing topsoil and vegetative cover on Area A. → improve cover on Area A • Modify surface water drainage patterns and provide erosion control during and after construction. • Excavate Areas B, C, and G and ditch segment adjacent to Area B on the east. • No Further Action at Areas D and F. • Transport and dispose excavated material at permitted off site facility. • Backfill excavated Area G with clean fill to within 6 inches of the surface. • Re-vegetate Areas B, C, and G. • Record development/use restrictions on property deed for Area A. • Continue maintenance of vegetation, stormwater management, and site security facilities. • Groundwater Monitoring

5.0 DETAILED ANALYSIS OF CORRECTIVE MEASURE ALTERNATIVES

5.1 EVALUATION CRITERIA

A detailed evaluation of alternatives must be conducted in accordance with the requirements for Corrective Action Plans, as detailed in the project Scope of Work issued by the USEPA and the "Corrective Measures Study Plan" prepared by ECKENFELDER INC.®, as well as the guidance provided by the "RCRA Corrective Action Plan (Interim Final)".

The purpose of this section is to perform a detailed analysis of the nine assembled alternatives as required by Task II of the Scope of Work taking into account site specific conditions. The detailed analysis includes a description of how each alternative will be implemented for the specific site area and an evaluation of each alternative using specific evaluation criteria; these alternatives will be carried forward into Section 6 for a comparative evaluation. Based upon the findings of the comparative analysis, a corrective measures recommendation will be made.

The criteria utilized to evaluate each assembled alternative, as required by Task II, are as follows:

- Technical
- Environmental
- Human Health
- Institutional

The criteria and specific factors related to each criteria which must also be evaluated are discussed in further detail below and are summarized in Table 5-1. In addition, cost estimates have been developed for each alternative.

5.1.1 Technical Factors

Technical factors which affect the suitability of the candidate alternative include performance, reliability, implementability, and safety. Performance is further judged based upon effectiveness and useful life, while reliability is measured based

TABLE 5-1

DETAILED ANALYSIS
ALTERNATIVE SELECTION/EVALUATION CRITERIA

RMI SODIUM FACILITY
ASHTABULA, OHIO

TECHNICAL

Performance
- Effectiveness
- Useful Life

Reliability
- O&M Requirements
- Demonstrated Reliability

Implementability
- Constructability
- Implementation Time

Safety
- Short Term
- Long Term

ENVIRONMENTAL

Beneficial Effects
- Short Term
- Long Term

Adverse Effects
- Short Term
- Long Term

HUMAN HEALTH

Potential for Exposure
- Short Term
- Long Term

Residual Contamination
- Reduction over Time
- Comparison to Existing Criteria, Standards, and Guidelines

INSTITUTIONAL

Public Health Standards
- Federal
- State
- Local

Regulations
Guidance
Advisories
Ordinances
Community Relations

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upon operation and maintenance requirements, as well as the alternative technology's demonstrated abilities. Factors which influence the implementability of an alternative include its constructability, ease of installation, internal and external site conditions, and time (both for implementation and for achieving the desired results). Safety will be evaluated with respect to nearby communities and environments, as appropriate, as well as workers implementing the corrective measures. However, it should be noted that potential receptors were extensively evaluated in the RFI and HEA. In the HEA, it was determined that, in addition to the RMI Sodium Plant being located in a highly industrialized area of Ashtabula County, only about 4 percent of the county is classified as residential. The major residential areas are located along Lake Erie in the areas of Ashtabula City, Kingsville, and Conneaut City. Within a three-mile radius of the RMI Sodium Plant, land use is primarily "unclassified", which includes vacant land (55 percent) and farmland (21 percent). Land use in the vicinity of the RMI Plant is shown in Figure 4-24 of the Revised RFI report.

There were only four residences identified in the immediate vicinity of the RMI Plant: two located on East 6th Street, approximately 1,000 feet west of the RMI plant entrance, or about 2,000 feet west of the majority of the waste management units; one located on Lake Road, approximately 500 feet west of the northwestern RMI property boundary, or about 2,000 feet northwest of the majority of the waste management units; and one located approximately 2,500 feet from the southwestern property boundary, or about 4,000 feet southwest of the majority of the waste management units. The areas east and north of the plant are largely industrial. The areas west and south of Route 11 are primarily residential and commercial.

Access to the RMI plant property is restricted. A chainlink fence surrounds the entire property boundary, and access to the plant is limited to RMI authorized personnel only, by means of 24 hour a day security guards. Given the extremely small local residential population and tight security measures in place, safety, with respect to current conditions and any potential on-site remedial activities, is not considered to be a concern.

The above information applies to the evaluation of all alternatives (and therefore should be considered in the remedy selection process) and will not be repeated in

the ensuing analysis. Other concerns with respect to any remedial activities involving off-site activities, however, will be noted in later discussions.

5.1.2 Environmental Factors

Environmental factors which affect the suitability of a candidate alternative include short and long term beneficial and adverse effects to implementation. In addition, existing facility conditions and pathways of potential migration identified as well as any environmentally sensitive areas must be considered. Corrective measures will be recommended to mitigate any potential adverse affects upon the facility or its surrounding environment due to alternative implementation.

With respect to potentially sensitive areas and the surrounding environment, the findings of the RFI and the HEA should be noted here since they apply to all alternatives, as well as existing conditions. The Sodium Plant property consists primarily of buildings, process areas, the waste management units, and other unregulated units such as the brine ponds. Although there are some open fields, there are no wooded areas on site which would provide a suitable habitat for most of the mammals, birds, and other wildlife endemic to the area. There may be rodents, transitory birds, and various invertebrate species present on site, but the absence of suitable habitats make the occurrence of significant numbers and varieties of wildlife highly unlikely.

As discussed in Section 4.2.4.2 of the Revised RFI report, there are no federal endangered or threatened species, nor federal lands managed for ecological value within a two-mile radius of the RMI Sodium Plant. There are also no existing or proposed state nature preserves or scenic rivers in that portion of Ashtabula County. There is, however, one "ecologically significant" area within a two-mile radius of the RMI Plant, Walnut Beach Park, located at the far northwestern boundary of the two-mile radius, on Lake Erie. In Walnut Park, there are four threatened species of plants, *Juncus alpinoarticulatus*; *Lathyrus iaponica*; *Myriophyllum heteronhyllum*; and *Potamogeton richardsonii*. Two of these species are perennial herbs and two are submersed aquatic plants. Although these species are present within a two-mile radius of the RMI Sodium Plant, there are no conceivable migration pathways of site constituents which may affect these species.

Since the existence of environmentally sensitive areas on site or within the study area are extremely limited and no conceivable migration pathways exists this factor will not be further addressed in alternatives analysis.

In the HEA, the potential migration pathways for constituents in on-site soils were described as leaching of constituents in surficial or subsurface soils into shallow groundwater; leaching of constituents in surficial soils to site drainage ditches; and potential erosion of constituents in surficial soils to air and/or on-site surface water drainage ditches. As discussed in the HEA, there are no expected receptors of shallow groundwater. And, as discussed in the HEA and as summarized below, there are no human or environmental receptors of significance in the immediate vicinity of the RMI Sodium Plant. Leaching of surficial soils to site surface water is not considered to be significant. Therefore, the only potential migration pathway of concern is erosion of surficial soils to on-site surface water ditches, and the potential subsequent transfer of soluble constituents in water or insoluble constituents in ditch sediments to locations downstream via the DS Tributary.

In light of these baseline facility conditions, further evaluation of migration pathways and evaluation of beneficial and adverse effects will be largely limited to erosion of surficial soils and constituent transport via the surface water pathway.

5.1.3 Human Health Factors

Human health factors affecting the viability of a candidate measure include the short and long term potential to residual concentration exposure; the reduction of residual concentrations over time; and the conformance of the corrective measure with any existing applicable criteria, standards, or guidelines. A baseline risk assessment, performed at the request of the USEPA, was conducted for soils for the constituents, depths, and areas of interest based on a comparison of site soil data to background levels and a comparison to USEPA action levels for the site. Exposure scenarios evaluated included both the current industrial worker population and the future industrial and residential populations. Considering all of the total estimated carcinogenic risks for both the current and future scenarios, including risk estimates for background soil, none of the total estimated carcinogenic risks for either the current or future scenarios exceeded the upper limit of USEPA's acceptable range (1×10^{-4}). Two future noncarcinogenic hazard indices exceeded

USEPA's acceptable limit of 2.0: potential residential exposure to surficial soils from Area B and potential residential exposure to surficial soils from Areas B and C combined. (Note: the combined area exceeded the limit because Area B exceeded the limit.) With the exceptions of these two risk estimates, all of the remaining total noncarcinogenic hazard indices were below USEPA's acceptable level of 1.0. Results of the baseline risk assessment have been included in Appendix A.

With respect to a comparison to existing standards, the findings of the HEA should be noted at this point as they apply to all alternatives and, therefore, will not be repeated in the ensuing analysis.

The HEA identified no receptors which may come in contact with surficial soils at the RMI Sodium Plant site. Consequently, a comparison with human or environmental exposure limit criteria was not appropriate. Instead, other benchmarks for the purposes of evaluating the significance of potential releases, and judged by the USEPA as protective of human health, welfare, and the environment were evaluated.

As discussed in Section 2.2.4, one such set of criteria identified by the HEA for potential use as a benchmark comparison are the proposed cumulative pollutant loading rates for regulating the land disposal of municipal sewage sludge. The USEPA has proposed these regulations to protect public health and the environment from any reasonably anticipated adverse effects of certain constituents which may be present in sewage sludge generated by publicly or privately owned treatment works, or any person who uses or disposes of sewage sludge from such treatment works. The proposed regulations establish requirements for the final use and disposal of sewage sludge when it is applied to land, distributed and marketed, placed in monofills, on surface disposal sites, or is incinerated. The criteria chosen for comparison were the annual cumulative pollutant loading rates for the land application of sewage sludge to agricultural or non-agricultural land for the constituents or interest in surficial soil (cadmium, arsenic, and lead).

As described in the RFI and in Section 2.2, the potential erosion of site constituents was identified as a potential migration pathway of concern. As no human receptors were identified in the HEA which were likely to contact site soils, and because the USEPA had no criteria to evaluate the significance of erosion rates or losses, the

proposed sewage sludge loading rates were presented in the HEA to address the significance of the estimated erosion rates of surficial soil.

Table 5-2 summarizes the highest estimated erosion losses from site surficial soils for each of the constituents of interest in surficial soil and the proposed sewage sludge disposal loading rates for those constituents. As shown in Table 5-2, none of the highest estimated erosion losses exceed the sewage sludge loading rates for these constituents. In fact, the estimated erosion rates are far below these loading rates, indicating that the erosion of site constituents in surficial soils was not of concern. (Note: These regulations became final on February 19, 1993 and the final loading rates for the constituents of interest were substantially higher, at least twice, the proposed levels. This indicates that the erosion rates are even less of a concern than previously thought.) This analysis was further supported by the conclusions of the baseline human health risk assessment for soil presented as Appendix A. The risk assessment showed that none of the soils in any site area presented unacceptable risks to current human receptors (which were conservatively assumed to be on-site industrial workers).

Therefore, based on the most conservative erosion estimates for the site and Agency-generated release criteria which were established to be protective of human health and the environment, it appears that none of the surficial soils on site present a potential concern with regard to erosion. However, as stated in their September 24, 1991 comments on the revised CMS Plan, the USEPA notes that this comparison does not have any regulatory significance for RCRA corrective action decisions.

Potential human health and safety concerns have also been identified which may occur during the implementation of each of the remedial alternatives. Potential health and safety effects on surrounding human populations are not expected to be significant, and are not an issue of concern with respect to the implementation of corrective measure alternatives (consider the industrial setting of the facility, the limited number of residences in close proximity to the site, current operational status of the site, and plant security to limit public access). However, limited short-term concerns have been identified for on-site personnel.

TABLE 5-2

COMPARISON OF HIGHEST ESTMATED EROSION LOSSES FROM SITE SURFICIAL SOILS WITH REGULATORY CRITERIA

RMI SODIUM FACILITY
ASHTABULA, OHIO

Constituent	Highest Estimated Erosion Loss		Sewage Sludge Disposal Cumulative Pollutant Loading Rates Ce[d]	
	(lb/yr)	(lb/acre-yr)	(Kg/hectare-yr)	(lb/acre-yr)
Cd	0.0824[a]	0.687[a]	18	16.1
Pb	0.604[c]	1.23[a]	125	112
As	0.121[c]	0.075[b]	14	12.5

[a]Measured or calculated from Area B.
[b]Measured or calculated from Area C.
[c]Measured or calculated from Area F.
[d]Proposed rule, 40 CFR 503, "Standards for the Disposal of Sewage Sludge;" (*Federal Register*, February 6, 1989 (*FR* 54(23): 5746-5902)

Generally, potential health and safety issues identified for the RMI Sodium Plant include exposure to windblown particles (fugitive dust), air emissions, fire and explosion, erosion due to precipitation, exposure to hazardous substances, and the unsafe operation of equipment associated with the excavation and movement of soil. All potential health and safety issues were considered in assessing the implementation of corrective measures; however; concerns stemming from unlikely hazards such as fire and explosion, and air emissions are not expected to be encountered at this site. All health and safety issues associated with the implementation of corrective measure alternatives are expected to be minimized by appropriate site controls and are expected to be protective of site workers, local residents, remedial site workers, and the environment. Where relevant, specific health and safety issues are addressed for each alternative.

5.1.4 Institutional Factors

Institutional factors include federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations.

5.1.5 Cost Estimate

Cost estimates include the anticipated capital expenditures and the operation and maintenance costs associated with each alternative. Capital costs include, as applicable, direct and indirect capital costs. Direct capital costs include construction, equipment, land and/or site development, building and/or service costs; while indirect capital costs are associated with items such as engineering and legal fees, licensing and permit fees, start up and shake down costs, as well as contingency allowances. Operation and maintenance (O&M) costs typically include those post-construction costs which are associated with the short and/or long term operation and maintenance of the alternative, associated materials and labor costs, as well as energy requirements of the alternative. Operation and maintenance expenditures may also include, on a case by case basis, items such as purchased services, periodic disposal and treatment costs, monitoring costs, administrative costs, insurance, and taxes. All capital and operation and maintenance cost estimates provided are 1993 costs.

5.2 ALTERNATIVE 1 - NO FURTHER ACTION

5.2.1 Alternative Description

This alternative consists of no further action in specified site corrective measure study areas. Current general site maintenance activities will continue and consist of maintenance of vegetation, stormwater management facilities, and continued site security measures.

5.2.2 Technical Evaluation

The implementation of this alternative requires no more than continuation of existing site maintenance activities. As such, implementability and reliability are not concerns. In addition, safety is not an issue as previously discussed under Section 5.1.1. Evaluation of the performance of this alternative indicates that the effectiveness would be limited in areas with surficial contamination (i.e., all site areas except Area D) since it does not address erosion and runoff, potential constituent transport in sediment and water in drainage areas, or infiltration and migration of constituents due to incident precipitation. However, with proper maintenance the useful life of this alternative is unlimited.

5.2.3 Environmental Evaluation

As stated above, the corrective measure objectives will not be met by this alternative in areas with surficial contamination. As such, there are no short or long term environmental benefits associated with this alternative. However, because average constituent concentrations in site areas are, in some cases, only marginally above the action levels and because these site areas are located on an industrial facility that will remain industrialized for the foreseeable future (since the area is heavily industrialized), the adverse effects of this alternative are minimal. This is further supported by the baseline risk assessment in which estimated risks quantified for the various exposure scenarios were demonstrated to be within allowable USEPA risk guidelines for all areas except Area B noncarcinogenic risks for the potential future adult residential populations.

5.2.4 Human Health Evaluation

As stated above, since these site areas are located within a secured industrial facility, the potential for short or long term exposure under conditions other than an industrial setting is not a concern. This is addressed in detail in Section 2 and is further supported by the baseline risk assessment (Appendix A) in which estimated risks quantified for the various exposure scenarios were demonstrated to be within allowable USEPA risk guidelines for all areas except Area B noncarcinogenic risks for the potential future adult residential population. While only minimal reduction of constituent concentrations over time is anticipated, the current concentrations, as previously discussed, have no current or future potential adverse effects on human health, and constituent concentrations in groundwater have been shown to be decreasing based on recent data.

Short-term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker to fugitive dust and the unsafe operation of maintenance equipment such as mowers and backhoes.

5.2.5 Institutional Evaluation

Institutional factors include federal, state, and local public health standards, regulations, guidance, advisories, ordinances or community relations. No institutional issues regarding this alternative are identified.

5.2.6 Cost Evaluation

No capital costs are associated with the No Further Action alternative and no operation and maintenance costs above those currently in place for the facility will be incurred with the implementation of this alternative.

5.3 ALTERNATIVE 2 - LIMITED INSTITUTIONAL ACTION

5.3.1 Alternative Description

The Limited Institutional Action alternative consists of continued site maintenance, including vegetation, stormwater management, and site security facilities, combined with periodic groundwater monitoring and recording land use/deed restrictions on the property deed.

5.3.2 Technical Evaluation

Institutional corrective measures are effective in the limitation of environmental and human exposure to the constituent source zone provided that fencing and site security measures are maintained into the future, as well as the continuance of current site maintenance of vegetative cover and stormwater management facilities. No unusual performance, reliability, implementability, or safety considerations are evident for the Limited Institutional Action alternative. Due to implementation of property deed restrictions, long term safety for this alternative is improved over that for the No Further Action alternative.

5.3.3 Environmental Evaluation

The long and short term environmental effects of this alternative are effectively the same as for the No Further Action alternative. However, as stated above, the implementation of property deed restrictions would represent an improvement in long term protection.

5.3.4 Human Health Evaluation

As with the No Further Action alternative, reduction of constituent concentrations over time is anticipated to be minimal. As previously discussed, however, concentrations do not exist at levels where current and future potential adverse effects on human health are a concern and, in the case of groundwater, constituent concentrations have been shown to be decreasing based on recent data. Implementation of site use and property deed restrictions would provide for some added level of protection against long term or future exposure.

Short-term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker to fugitive dust and the unsafe operation of maintenance equipment such as mowers and backhoes.

5.3.5 Institutional Evaluation

Institutional factors include federal, state, and local public health standards, regulations, guidance, advisories, ordinances or community relations. Institutional factors which may be relevant include requirements for local building permits and/or soil/erosion control plan approval.

5.3.6 Cost Evaluation

Capital costs associated with this alternative are estimated to be $10,000. Additionally, the annual operation and maintenance costs are estimated to be $10,000 for groundwater monitoring.

5.4 ALTERNATIVE 3 - SOURCE CONTAINMENT

5.4.1 Alternative Description

The source containment vegetative cover alternative consists of the restoration or replacement of the existing vegetative cover in Areas B and C, D, F, and G by placement of a 6-inch layer of topsoil over each site area and seeding and fertilizing. Conventional stormwater and erosion control measures will be implemented prior to construction activities and final grading will restore stormwater runoff to its original pattern. Implementation of this alternative also includes recording of development/site use restrictions on the property deed. Maintenance requirements include watering, mowing, revegetation of the cover, and periodic groundwater monitoring.

5.4.2 Technical Evaluation

Implementation of this alternative will not reduce the potential for transport of constituents already present in sediment and water in the drainage ditches. However, proper vegetative cover will reduce future erosion and constituent runoff from site areas and will also reduce infiltration and constituent migration due to incident precipitation. Therefore, restoration and vegetative cover maintenance is a technically viable alternative for the prevention of further constituent migration and human contact. The useful life of this alternative is essentially indefinite (with proper maintenance), and it is easily implemented, reliable, and safe.

5.4.3 Environmental Evaluation

The long and short term beneficial environmental effects of this alternative include reduction of erosion, runoff, infiltration, and migration of site constituents. These effects would be realized almost immediately. No adverse environmental impacts associated with the implementation of this alternative are evident and it is expected that the overall surface water runoff quality will be improved over present conditions.

5.4.4 Human Health Evaluation

It is anticipated that the installation and implementation of a vegetative cover, combined with the facility's existing site maintenance plan, will sufficiently reduce long term and short term exposure potential. Also, while this alternative will not help to reduce constituent concentration over time, current concentrations have no current or future potential adverse effects on human health, and constituent concentrations in groundwater have been shown to be decreasing based on recent data.

Short-term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork and maintenance equipment. Site controls, such as erosion control measures, will be implemented to prevent potential exposure from migration of surficial soil into surface water.

5.4.5 Institutional Evaluation

Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil/erosion control plan approval.

5.4.6 Cost Evaluation

Costs for implementation of this alternative are estimated to be $103,000 for capital costs and $17,000 for annual O&M costs.

5.5 EXCAVATION AND ON-SITE DISPOSAL

5.5.1 Alternative 4A - Excavation of Areas B and C, D, F, and G; and On-Site Disposal at Area A

5.5.1.1 Alternative Description. This alternative consists of the excavation of Areas B, C, D, F, and G; transport and placement (on-site disposal) of the excavated soil over one-half of Area A; and construction of a cover over the affected soil. Two cover options were considered in evaluating this alternative: a 1-foot clay layer underlying a 1-foot topsoil layer, and a synthetic cover consisting of a geomembrane over the affected soil, overlain by a composite geonet, and then a 4-foot soil cover. Implementation of this alternative also includes excavation of approximately 100 cubic yards of sediments from the drainage ditch segment immediately east of Area B. This volume represents an approximate depth of 6 inches over a length of approximately 200 feet. This material will be dewatered prior to placement in Area A. Areas B and C, D, F, and G will be subsequently filled to grade with clean backfill and/or topsoil, vegetated, and maintained as required. The present layer of unaffected topsoil and vegetation at Area A will be stripped and stockpiled for reuse in the cover system; no wastes are anticipated to be disturbed. Area surface water drainage patterns will be modified as needed prior to construction to prevent erosion and/or runoff from entering the ditches. The areas will be returned to existing conditions subsequent to construction. The excavated material will be spread evenly across one-half of the surface of Area A and this area will then be

capped using one of the two options identified above. The use of Area A will be restricted in the property deed.

Implementation of these corrective measures is not expected to impact the DNAPL existing beneath Area A because the DNAPL is deeper than the bottom of the landfill and existing fill in Area A will not be disturbed. This DNAPL has been determined to be originating off site south of the RMI Sodium Plant. This determination is supported by a report regarding potential sources of contamination at the Fields Brook Superfund Site. The report, entitled "Fields Brook Source Control Operable Unit Remedial Investigation Report" (Woodward-Clyde, 1992), identifies the facility immediately adjacent to the southern RMI property boundary as producing organic solvent materials over the years. This facility is reported to have utilized several surface impoundments as settling ponds. All of these lagoons were located in the northeast portion of that property (immediately south of the RMI landfill).

The total volume of material to be excavated from site areas and transported is anticipated to be approximately 10,540 cubic yards (284,600 cubic feet). A summary of all excavation volumes and their development is provided in Table 4-6. Factors considered in the volume calculations include the rounding up of constituent source zone excavation depths to the nearest 0.5 foot for study purposes and the designation of the study area to be bounded by existing structures and features. Anticipated excavation sequencing, haul routes, and temporary stockpile areas (if needed) associated with this alternative are shown in Figure 5-1. Generally, if necessary, all constituent source zone material can be temporarily stockpiled in Areas B and C (prior to its corrective action), provided that the material is covered and an earthen berm is constructed around the stockpile area to prevent run-on or constituent migration from wind and rainfall.

Topsoil stripped from Area A, prior to reuse in the final cover system, may be temporarily stockpiled in the vacant area immediately north of Area A. It is anticipated that an area approximately 200 feet by 200 feet will be required; this stockpile must be surrounded by straw bales and may also need to be covered with plastic sheeting (such as polyethylene) to protect against erosive forces and run-on.

B AND C : AREAS NORTHEAST AND NORTHWEST OF CLOSED LANDFILL, RESPECTIVELY

D: FORMER FILL AREA IN VICINTY OF WASTEWATER TREATMENTPONDS.

G: FILL AREA NORTH OF WASTEWATER TREATMENT PONDS.

A : CLOSED LANDFILL

F : FILL AREAS WEST OF WASTEWATER TREATMENT PONDS

TEMPORARY TOPSOIL STOCKPILE AREA

DRAINAGE DITCH

DRAINAGE DITCH

ASHCO RESERVOIR

CELL ROOM

OFFICE BUILDING

STATE ROAD

RMI PARKING LOT

LEGEND:

- PIEZOMETER
- STREAM GAUGE
- MONITORING WELL
- SOIL BORING
- SUPPLEMENTAL PIEZOMETER
- SUPPLEMENTAL STREAM GAUGE
- SUPPLEMENTAL MONITORING WELL
- SUPPLEMENTAL STREAM GAUGE, SURFACE WATER AND SEDIMENT SAMPLE LOCATION
- SUPPLEMENTAL SEDIMENT SAMPLE LOCATION
- GENERAL LIMIT OF CORRECTIVE MEASURE AREA
- GENERAL HAUL ROUTE
- 640 INDEX CONTOUR (CONTOUR INTERVAL = 2 FEET)

NOTE:

1. Clay and soil cap system to extend 5 feet beyond the surveyed limit of area A.

100 0 100 200
scale feet

NO.	REVISIONS	REV'D BY	DATE	APPRO'D BY
1	Haul Route, Area A		2/25	

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Ashtabula, Ohio

FIGURE 5-1
PROPOSED LAYOUT OF CORRECTIVE MEASURE HAUL ROUTES AND AREAS

SCALE: 1" = 100'

DRAWN BY	DATE	CHECKED BY	APPROVED BY
	8/91		

DRAWING NUMBER 6497

Excavation activities will involve surficial excavation in Areas B, C, and F, while Area D will be excavated to a depth of 6.5 feet and Area G will be excavated to a depth of 3.5 feet. Excavated material will be placed over one-half of Area A at a uniform depth of approximately 2 feet, where it will then be compacted during placement and graded to accept the low permeability cover. Placement of the excavated material in Area A will be at the eastern most half in order to minimize changes in topographical relief. The increase in overall height of disposal Area A after the addition of the full cap is projected to be less than 5 feet. Excavation of the ditch sediment along the east side of Areas B and C will require measures to prevent erosion of sediments while under remediation. Temporary diversion berms will be placed at upstream and downstream locations while the working portion of the ditch is dewatered and allowed to dry prior to excavation. Runoff normally entering the ditch will be temporarily diverted by pumping. While no other special circumstances are expected to be experienced for the implementation of this alternative, existing facility utilities should be field located in all proposed areas of excavation prior to implementation of any activities. It is anticipated that excavation activities will be conducted using readily available excavation equipment.

Excavations at Areas D and G will be backfilled to within 6 inches of existing grade with a clean earthen material borrowed from an off-site location. The remaining 6 inches of the excavated areas (B, C, D, F, and G) will be leveled off with a regional topsoil capable of sustaining a vegetative cover. Final grading is intended to restore surface water drainage patterns. The backfilled areas should be protected from erosion with hay bales, silt fencing, or other effective erosion and sediment control barrier until proper vegetation has been established. Each area should be revegetated using a seed variety commercially available in the Ashtabula region.

Additional considerations for closure and post closure requirements for remedies that involve on-site disposal are evaluated for each of the cap options to be presented. These considerations are designed to satisfy the requirements of federal and state solid waste regulations and be protective of human health and the environment. Although discussed in general below, these considerations will be more appropriately addressed during the design stages of the project, as necessary.

Typically, closure considerations include the type and amount of waste to be disposed on site; the mobility and expected rate of migration of hazardous waste constituents; site location and topography; hydrogeology and geology; climate (i.e., rainfall, frequency, freeze/thaw cycles, wet/dry cycles, and protection from desiccation; surrounding land use with respect to the potential effects of contaminant migration (remedy should be protective of human health and the environment, i.e. groundwater and surface water), and; minimizing infiltration, maintenance, erosion, settling and subsidence.

Although not intended to be the final and/or complete list of cap design standards and construction requirements, applicable design and construction standards evaluated with respect to potential cap options include cap material characteristics. For geosynthetic construction materials, considerations include flexible membrane liner type and thickness (e.g., 40 mil HDPE) and compatibility of liner and waste materials. For soil cap design and construction, considerations include soil type and properties, such as porosity and permeability (maximum permeability of $1x10^{-7}$ cm/s), particle size, optimum moisture-density to achieve adequate compaction, and slope stability, friction angle between soil-geosynthetic interface, length of run, etc. In addition, the cap soil should be free of debris or foreign material and the type of vegetative cover used should be indigenous to the region.

Post-closure considerations include maintaining the integrity and effectiveness of the cap (i.e., establishing an operation and maintenance program to correct the effects of settling, subsidence, and preventing run-on and run-off from eroding or otherwise damaging the cap), developing a groundwater monitoring system that can detect the presence and off-site migration of constituents of concern, and maintaining and protecting survey bench marks.

Most of these considerations are applicable to both the proposed geosynthetic cap system and the soil cap system. Generally, only those issues in which special consideration is required are discussed in the following evaluation of proposed cap alternatives.

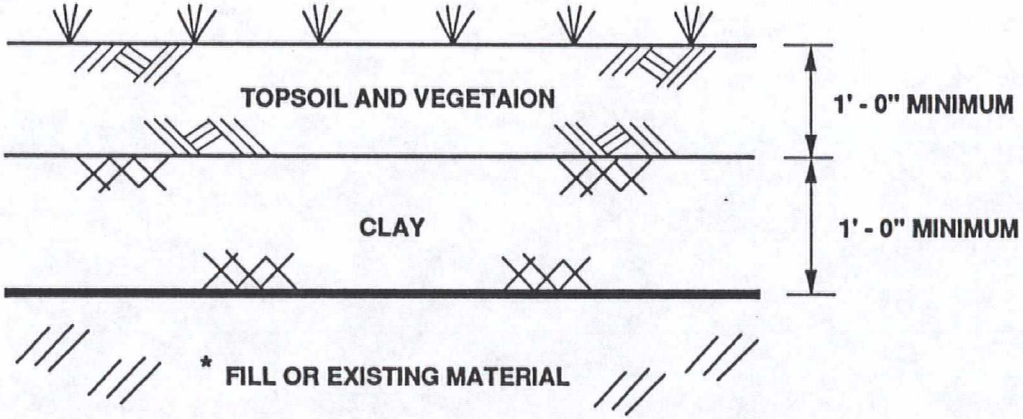
The installed soil cover system consists of the excavated material overlain with a low permeability clay cap and a topsoil and vegetative cover. A minimum topsoil depth of 1 foot is recommended for long term protection and integrity of the cap and

to accommodate the root systems of the vegetative cover. It is anticipated that existing stormwater management utilities will receive runoff from the newly capped facility in the same manner that they currently receive runoff and that no modifications will be necessary at this point in time. The minimum recommended slope for the cap is 3 percent and a maximum slope should not exceed 5 percent; typically, however, the grade of the proposed fill and cap should generally follow the existing topographic trends of Area A. Figure 5-2 shows the general cross section of the proposed cap.

Recommended low permeability soil characteristics should meet the criteria of a Unified Soil Classification of type CH or CL and a maximum coefficient of permeability of 1.0×10^{-7} cm/sec. The clay should be placed in 6 inch compacted lifts to achieve a minimum in place compacted depth of one foot. Clay placed in such a manner, at optimum moisture, should not heave or crack. Although waste settlement may cause movement in the clay liner, the clay should be self repairing at moist conditions.

The other cap design option discussed for this alternative consists of identical components as described above with the exception that a geomembrane system would be placed over the affected soil in lieu of the clay cover system. Components of the geomembrane cap system include the graded and compacted base material (either the existing ground surface or the excavated waste material) adequately prepared to accept the geomembrane, overlain by a synthetic drainage layer, all of which is overlain and protected by a minimum of 3.5 feet of clean fill and 0.5 foot of topsoil that will sustain vegetative growth. This capping system meets the intent of RCRA guidance documents for hazardous waste landfill caps. Additionally, this design is equivalent to requirements set forth by Ohio Administrative Code 3745-27-11.

As described previously, excavated material from Areas B, C, D, F, and G would be placed uniformly over one-half of Area A. The geomembrane (minimum 20 mils thick) would be paced directly over the finished surface of the excavated material to minimize small-scale stress points. Due to the inert nature of the inorganic contaminants within the excavated material, compatibility problems between the liner and contaminants are not anticipated thereby allowing the excavated material to serve as the low hydraulic conductivity liner foundation material. The uppermost lift (12 inches) of this excavated material should be free of detrimental rock or other



TYPICAL SOIL AND CLAY CAP SECTION

* IN THE EVENT THAT EXISTING MATERIAL IS NOT USED, FILL (EXCAVATED MATERIAL) WILL BE PLACED AT A UNIFORM THICKNESS

NOT TO SCALE

RMI SODIUM FACILITY
Ashtabula, Ohio

FIGURE 5-2
TYPICAL SOIL AND CLAY
CAP SECTION

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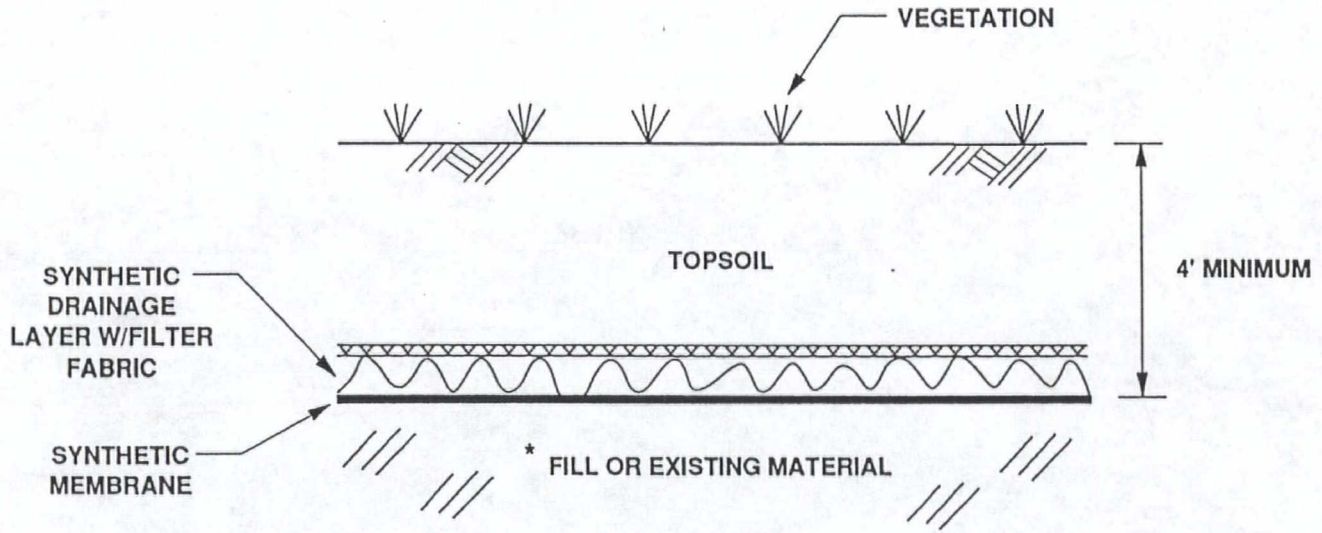
debris and should be compacted and graded smoothly with a maximum slope of 3 percent. The synthetic drainage layer which overlies the geomembrane is designed to hydraulically transmit the equivalent volume of 1 foot of sand with an hydraulic conductivity of 1 x 10^{-2} cm/sec. A layer of filter fabric designed to prevent soil fines from clogging or migrating though the drainage layer overlies the drainage net to make up the composite drainage layer. Water that migrates through the topsoil cover and drainage layer would be intercepted by a toe drain around the slope base perimeter. A minimum of 4 feet of topsoil, including the vegetative layer, would be paced over the synthetic liner system to protect from frost and erosion. Slopes should be 5 percent or less to minimize soil cover lost by erosion. A typical cross section of the proposed cap is shown in Figure 5-3.

It is assumed for the purpose of this evaluation that the existing topsoil is characteristic of productive topsoils in the region and that a similar soil is readily available to make up the additional depth to provide a minimum 1 foot soil layer. Grass seed should be a mix commercially available in the Ashtabula region. The topsoil should be placed uncompacted. Stormwater runoff from Area A is anticipated to follow the route of existing drainage patterns.

Maintenance requirements include periodic groundwater monitoring; routine inspection, watering, revegetating, and mowing of the vegetative cover; and general repair associated with damage from heavy rainfall events, freeze/thaw events, settlement of the placed material, and burrowing animals.

5.5.1.2 Technical Evaluation. This alternative is technically feasible in all aspects for the facility conditions and fully addresses corrective action objectives. Both excavation and capping are safe, effective, and reliable alternatives. With proper maintenance and protection, the useful life of a cap is expected to be indefinite. Erosion, runoff, and constituent migration due to infiltration and percolation of incident precipitation and stormwater will be virtually eliminated, as will the potential for direct contact. In addition, the potential for future groundwater contamination is significantly reduced by excavation, consolidation, and capping of the waste sources. The potential for constituent transport in sediment and water in the ditch will be reduced by excavation of the sediment in the ditch adjacent to Area B. Operation and maintenance requirements are not



TYPICAL GEOMEMBRANE COVER SYSTEM SECTION

* IN THE EVENT THAT EXISTING MATERIAL IS NOT USED, FILL (EXCAVATED MATERIAL) WILL BE PLACED AT A UNIFORM THICKNESS

NOT TO SCALE

RMI SODIUM FACILITY
Ashtabula, Ohio

FIGURE 5-3
TYPICAL GEOMEMBRANE COVER SYSTEM SECTION

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sufficiently different from the existing facility's site maintenance plan, with the exception of the addition of groundwater monitoring.

Implementability is not anticipated to be difficult due to the shallow soil/sediment depths requiring excavation, the existence of Area A for on-site placement of excavated material, and readily available haul roads which are easily maintained. However, existing utilities may create difficulty in implementation based upon actual field location prior to construction activities. A review of utility plans prepared for RMI in August 1981 reveals some information regarding underground utilities, but leaves some areas open to interpretation (i.e., at least two separate elevation datums are utilized and are not referenced to one another or to a nationally or regionally recognized datum). This map has been compiled from several utility plans and surveys conducted through the facility's life. It should be noted that this utilities plan may not necessarily show all underground utilities (i.e., the french drain system at the existing wastewater treatment facilities).

5.5.1.3 Environmental Evaluation. Excavation and subsequent backfill and revegetation sufficiently achieves all environmental criteria at Areas B, C, D, F, and G due to removal of constituents from the site areas. On-site disposal at Area A, followed by capping the fill material with either a clay and soil cap or a synthetic liner and soil cover, sufficiently reduces potential constituent migration pathways in the environment by consolidating the affected soil and sediment and sandwiching the material between the clay layer and another cover system . The upper cap is protected with a soil and vegetative cover. The removal of constituent sources from Areas B, C, D, F, and G and consolidation at Area A, with construction of an additional cover system over the excavated material, will substantially reduce the potential for the sources to potentially contaminate groundwater in the future. Therefore, constituent concentrations in the groundwater are anticipated to be reduced over time. There are no obvious adverse environmental effects to this alternative.

5.5.1.4 Human Health Evaluation. The combined excavation/on-site disposal alternative eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via

erosive forces, and reducing the potential for constituent migration due to incident precipitation.

Short term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork and maintenance equipment. Site controls, such as erosion control measures, will be implemented to prevent potential exposure from migration of surficial soil into surface water.

5.5.1.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil/erosion control plan approval.

5.5.1.6 Cost Evaluation. Capital and operation and maintenance costs for the excavation, fill, transportation, and cover system are estimated to be $589,000 and $23,000, respectively, for the clay cover system, and $800,000 and $23,000, respectively, for the synthetic cover system.

5.5.2 Alternative 4B - Excavation of Areas B and C, F, and G; On-Site Disposal at Area A; No Further Action at Area D

5.5.2.1 Alternative Description. This alternative consists of the same components (and cap options) as described above for Alternative 4A, with the exception of corrective measures for Area D. This alternative includes No Further Action at Area D. The use of Area A will be restricted in the property deed.

Excavation activities will involve surficial excavation in the Areas B and C and Area F, while Area G will be excavated to a depth of 3.5 feet. The total volume of material to be excavated and transported is anticipated to be approximately 8,600 cubic yards (231,715 cubic feet). A summary of all excavation volumes and their development is provided in Table 4-6. Factors considered in the calculations include the rounding up of constituent source zone excavation depths to the nearest 0.5 foot for study purposes and the designation of the study area to be bounded by

existing structures and features. Anticipated excavation sequencing, haul routes, and temporary stockpile areas (if required) associated with this alternative are shown in Figure 5-1. Generally, if necessary, all constituent source zone material can be temporarily stockpiled in Areas B and C (prior to its corrective action), provided that the material is covered and an earthen berm is constructed around the stockpile area to prevent erosion or constituent migration from wind and rainfall.

5.5.2.2 Technical Evaluation. This alternative is technically viable in all aspects for the facility conditions and corrective action objectives. Both excavation and capping are safe, effective, and reliable alternatives. Infiltration and percolation of incident precipitation and stormwater resulting in potential constituent migration will be virtually eliminated for all site areas except Area D. However, the RFI and HEA have indicated that the site constituents are relatively immobile. The affected soil at Area D is located at a depth range of 3.0 feet to 6.5 feet below ground surface, thus, the top 3 feet act as an effective cover preventing direct contact and preventing constituent migration due to erosion. In addition, the HEA indicated that constituent concentrations in soil associated with Area D (as well as all of the SWMUs) did not pose a significant risk. Implementation of this alternative will remove all affected surficial soils thereby eliminating the potential for direct contact, the potential for constituent transport in the sediment and water in the drainage ditch, and the potential for transport of site constituents via erosion and surface runoff. In addition, the potential for future groundwater contamination is significantly reduced by excavation, consolidation, and capping of the waste sources. Operation and maintenance requirements are not sufficiently different from the existing facility's site maintenance plan, with the exception of the addition of periodic groundwater monitoring.

As with Alternative 4A, implementability is not anticipated to be difficult due to the shallow soil/sediment depths requiring excavation, the existence of Area A for on-site placement of excavated material, and readily available haul roads which are easily maintained. As discussed previously, existing utilities may create difficulty in implementation based upon actual field location prior to construction activities.

5.5.2.3 Environmental Evaluation. Excavation and subsequent backfill and revegetation sufficiently achieves all environmental objectives at Areas B, C, F, and

G. Removal of constituent source zone effectively eliminates all environmental concerns due to the removal of the constituent material from the area. On-site disposal at Area A, followed by capping the fill material with either a clay and soil cap or a synthetic cover system, significantly reduces potential constituent migration pathways in the environment by consolidating the affected soil and sediment and sandwiching the material between the existing clay layer and another cover system and protecting the upper cap with a soil and vegetative cover. Because the affected soils at Area D are located approximately 3 feet below ground surface, the measured levels are only slightly above the USEPA action level, and the baseline risk assessment shows that all estimated risks for Area D are within USEPA acceptable limits, no action at Area D in conjunction with excavation and disposal at other site areas sufficiently addresses environmental criteria. There are no adverse affects to this alternative.

5.5.2.4 Human Health Evaluation. The combined excavation/on-site disposal alternative eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via erosive forces, and reducing the potential for constituent migration due to incident precipitation.

Short term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork and maintenance equipment. Site controls, such as erosion control measures, will be implemented to prevent potential exposure from migration of surficial soil into surface water.

5.5.2.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil/erosion control plan approval.

5.5.2.6 Cost Evaluation. Capital and operation and maintenance costs for the excavation, fill, transportation, and cover systems are estimated to be $520,000 and

$23,000, respectively, for the clay cover system, and $750,000 and $23,000, respectively, for the synthetic cover system.

5.5.3 Alternative 4C - Excavation of Areas B and C and F; On-Site Disposal at Area G; No Further Action at Area D

5.5.3.1 Alternative Description. This alternative consists of the excavation of Areas B, C, and F and transport to Area G for on-site disposal. Implementation of this alternative also includes excavation of approximately 100 cubic yards of sediment from the drainage ditch segment immediately east of Area B. This volume represents an approximate depth of 6 inches over a length of approximately 200 feet. This material will be dewatered prior to placement in Area G. Areas B, C, and F will be subsequently filled to grade, vegetated, and maintained as required. The excavated material will be spread evenly across the surface of Area G and Area G will then be capped with either of the design options described for Alternative 4A and 4B and vegetated. The use of Areas A and G will be restricted in the property deed.

The total volume of material to be excavated and transported is anticipated to be approximately 2,100 cubic yards (56,715 cubic feet). A summary of all excavation volumes and their development is provided in Table 4-6. Factors considered in the calculation include the rounding up of constituent source zone excavation depths to the nearest 0.5 foot for study purposes and the designation of the study area to be bounded by existing structures and features. Anticipated excavation sequencing, haul routes, and temporary stockpile areas (if required) associated with this alternative are shown in Figure 5-1. All temporarily placed material must be covered with a plastic sheeting (such as polyethylene) and an earthen berm should be constructed around the stockpile area to prevent constituent migration from wind and rainfall.

Makeup/borrow material (clay and/or topsoil) obtained from an off-site source for either cover system may be temporarily stockpiled in the vacant area immediately north of Area G. This stockpile must be surrounded by straw bales and may also need to be covered with plastic sheeting (such as polyethylene) to protect against erosive forces.

Excavation activities will involve surficial excavation in the Areas B and C and Area F. While no special circumstances are expected to be experienced for the implementation of this alternative, existing facility utilities should be field located in all proposed areas of excavation prior to implementation of any activities. It is anticipated that these activities will be conducted using readily available excavation equipment.

All excavated areas will be backfilled to existing grade with an earthen material borrowed from an off-site location. Existing grade is intended to include the maintenance of existing surface water drainage patterns. The backfilled areas should be protected from erosion with hay bales, silt fencing, or other effective erosion and sediment control barrier, and each area should be revegetated by seeding with a mix commercially available in the Ashtabula region. The area should be protected until a sufficient stand of grass is present to preclude any erosion or sedimentation.

The excavated material is intended to be spread uniformly across the surface of Area G prior to placement of the selected cover system. No stripping of the existing topsoil and vegetation will occur to prevent potential transport of area constituents detected in the surface soils. Cross sections of the proposed cover systems are depicted in Figures 5-2 and 5-3. Construction of the cover system is anticipated to be the same as previously described.

Maintenance requirements include periodic groundwater monitoring; routine inspection, watering, revegetating, and mowing of the cover; and general repair associated with damage from heavy rainfall events, freeze/thaw events, settlement of the placed material, and burrowing animals.

5.5.3.2 Technical Evaluation. This alternative is technically viable in all aspects for the facility conditions and corrective action objectives. Both excavation and capping are safe, effective, and reliable alternatives. Infiltration and percolation of incident precipitation and stormwater will be virtually eliminated for all site areas except Area D. However, the RFI and HEA have indicated that the site constituents are relatively immobile. The affected soil at Area D is located at a depth range of 3.0 feet to 6.5 feet below ground surface, thus, the top 3 feet act as an effective cover preventing direct contact and preventing constituent migration due

to erosion. In addition, the HEA indicated that constituent concentrations in soil associated with Area D (as well as all of the SWMUs) did not pose a significant risk. Implementation of this alternative will remove all affected surficial soils thereby eliminating the potential for direct contact, the potential for constituent transport in the sediment and water in the drainage ditch, and the potential for transport of site constituents via erosion and surface water runoff. In addition, the potential for future groundwater contamination is significantly reduced by excavation, consolidation, and capping of the waste sources. Operation and maintenance requirements are not sufficiently different from the existing facility's site maintenance plan, except for the addition of periodic groundwater monitoring.

As with other excavation and on-site disposal alternatives discussed previously, implementability is not anticipated to be difficult due to the shallow depths requiring excavation and readily available haul roads which are easily maintained. However, as also discussed above, existing utilities may create difficulty in implementation based upon actual field location prior to construction activities.

5.5.3.3 Environmental Evaluation. Excavation, subsequent backfill, cover system placement, and revegetation sufficiently achieves all environmental objectives at Areas B, C, F, and G. Removal of the constituent source zone effectively eliminates all environmental concerns due to the removal of the constituent material from the area. On-site disposal at Area G, followed by capping the fill material, sufficiently reduces potential constituent migration pathways in the environment by consolidating the affected soil and sediment and protecting the material with a cover system. Because the affected soils at Area D are located approximately 3 feet below the ground surface, the measured levels are only slightly above the USEPA action level, and the baseline risk assessment shows that all estimated risks for Area D are within USEPA acceptable limits, no action at Area D, in conjunction with excavation and on-site disposal at other site areas, sufficiently addresses environmental criteria. There are no adverse environmental effects associated with this alternative.

5.5.3.4 Human Health Evaluation. The combined excavation/on-site disposal alternative eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via

erosive forces, and reducing the potential for constituent migration due to incident precipitation. Reductions in constituent concentrations over time are expected to be minimal.

Short term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork and maintenance equipment. Site controls, such as erosion control measures, will be implemented to prevent potential exposure from migration of surficial soil into surface water.

5.5.3.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil/erosion control plan approval.

5.5.3.6 Cost Evaluation. Capital and operation and maintenance costs for the excavation, fill, transportation, and cover system are estimated to be $202,000 and $19,000, respectively, for the clay cover system, and $260,000 and $19,000, respectively, for the synthetic cover system.

5.5.4 Alternative 4D - Excavation of Area F; On-Site Disposal at Area G; Containment at Areas B, C, D and G

5.5.4.1 Alternative Description. This alternative requires that Area F is excavated and hauled to Area G, and that Areas B, C, D, and G are covered with one of two cover system systems identical to those described for Alternative 4A. Area F will then be revegetated. The use of Areas A, B, C, D, and G will be restricted in the property deed.

Excavation activities will involve surficial excavation at Area F. The total volume of material to be excavated and transported is anticipated to be approximately 743 cubic yards. Details of the excavation, hauling, stockpiling, and erosion control at Area F are identical to those described in Alternative 4A.

5.5.4.2 Technical Evaluation. This alternative would be appropriate for the facility conditions and would satisfy corrective action objectives. However, this alternative is less effective from a practical standpoint because of the size and number of areas to be capped. Both excavation and capping are safe, effective, and reliable alternatives. Potential constituent migration from infiltration and percolation of surface water will be virtually eliminated for all site areas. Implementation of this alternative will remove affected surficial soils at Area F, eliminate the potential for direct contact in all corrective measure areas, and the potential for transport of site constituents via erosion and surface runoff. Operation and maintenance requirements are identical to those identified for Alternative 3, but are increased by the additional areas capped under this alternative.

Implementability would be more difficult, relative to other alternatives evaluated, due to the installation of multiple caps over Areas B, C, D, and G. This option would in fact minimize economies of size only to avoid excavation of Areas B, C, and D. As discussed previously, existing utilities may create difficulty in implementation based upon actual field location prior to construction activities.

5.5.4.3 Environmental Evaluation. Excavation, cover system placement, and revegetation sufficiently achieves all environmental objectives at Areas B, C, D, F, and G. Removal of the constituent source zone at Area F effectively eliminates all environmental concerns due to the removal of the constituent material from this area. On-site disposal of excavated material from Area F at G followed by capping of Areas B, C, D, and G, significantly reduces potential constituent migration pathways in the environment by containing the material, and protecting the cover system with a soil vegetative cover.

5.5.4.4 Human Health Evaluation. The combined excavation at Area F and disposal at Area G with placement of a cover system at Areas B, C, D, and G eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via erosive forces, and reducing the potential for constituent migration due to incident precipitation. Reductions in constituent concentrations over time are expected to be minimal.

Short term health and safety issues identified with the implementation and continued maintenance of this alternative are expected to be minimal, and include preventing exposure of the site worker, site remedial worker, and local residential population to fugitive dust and the unsafe operation of earthwork and maintenance equipment. Site controls, such as erosion control measures, will be implemented to prevent potential exposure from migration of surficial soil into surface water.

5.5.4.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil/erosion control plan approval.

5.5.4.6 Cost Evaluation. Capital and operation and maintenance costs for the excavation and revegetation of Area F and capping of Areas B, C, D, and G are estimated at $292,000 and $19,000, respectively, for the soil cover system and $464,000 and $19,000, respectively, for the synthetic cover system.

5.5.5 Alternative 4E - Excavation of Areas B, C, and G; On-Site Disposal at Area A; No Further Action at Areas D and F

5.5.5.1 Alternative Description. This alternative consists of the same components (and cap options) as described above for Alternative 4A, with the exception of corrective measures for Areas D and F. This alternative includes No Further Action at Areas D and F. The use of Area A will be restricted in the property deed.

Excavation activities will involve surficial excavation in the Areas B and C, while Area G will be excavated to a depth of 3.5 feet. The total volume of material to be excavated and transported is anticipated to be approximately 7,850 cubic yards. A summary of all excavation volumes and their development is provided in Table 4-6. Factors considered in the calculations include the rounding up of constituent source zone, excavation depths to the nearest 0.5 foot for study purposes and the designation of the study area to be bounded by existing structures and features. Anticipated excavation sequencing, haul routes, and temporary stockpile areas (if

required) associated with this alternative are identical to those described in Alternative 4A and are shown in Figure 5-1.

5.5.5.2 Technical Evaluation. This alternative is technically viable in all aspects for the facility conditions and corrective action objectives. Both excavation and capping are safe, effective, and reliable alternatives. Infiltration and percolation of incident precipitation and stormwater resulting in potential constituent migration will be virtually eliminated for all site areas except Areas D and F. However, the RFI and HEA have indicated that the site constituents are relatively immobile. The affected soil at Area D is located at a depth range of 3.0 feet to 6.5 feet below ground surface, thus, the top 3 feet act as an effective cover preventing direct contact and preventing constituent migration due to erosion. In addition, the HEA indicated that constituent concentrations in soil associated with Areas D and F (as well as all of the SWMUs) did not pose a significant risk. Implementation of this alternative will remove affected surficial soils (except in Area F) thereby eliminating the potential for direct contact, the potential for constituent transport in the sediment and water in the drainage ditch, and the potential for transport of site constituents via erosion and surface runoff. In addition, the potential for future groundwater contamination is significantly reduced by excavation, consolidation, and capping of the waste sources. Operation and maintenance requirements are not sufficiently different from the existing facility's site maintenance plan, with the exception of the addition of periodic groundwater monitoring.

As with Alternative 4A, implementability is not anticipated to be difficult due to the shallow soil/sediment depths requiring excavation, the existence of Area A for on-site placement of excavated material, and readily available haul roads which are easily maintained. As discussed previously, existing utilities may create difficulty in implementation based upon actual field location prior to construction activities.

5.5.5.3 Environmental Evaluation. Excavation and subsequent backfill and revegetation sufficiently achieves all environmental objectives at Areas B, C, and G. Removal of constituent source zone effectively eliminates all environmental concerns due to the removal of the constituent material from the area. On-site disposal at Area A, followed by capping the fill material with either a clay and soil cap or a synthetic cover system, significantly reduces potential constituent migration pathways in the environment by consolidating the affected soil and

sediment and sandwiching the material between the existing clay layer and another cover system and protecting the upper cap with a soil and vegetative cover. Because the affected soils at Area D are located approximately 3 feet below ground surface, the measured levels in Areas D and F are only slightly above the USEPA action level, and the baseline risk assessment shows that all estimated risks for Areas D and F are within USEPA acceptable limits, no action at Areas D and F, in conjunction with excavation and disposal at other site areas, sufficiently addresses environmental criteria. There are no adverse affects to this alternative.

5.5.5.4 Human Health Evaluation. The combined excavation/on-site disposal alternative eliminates all identified short and long term human exposure pathways by eliminating the possibility of direct human contact with the material, eliminating the material's ability to be transported to an area of potential human contact via erosive forces, and reducing the potential for constituent migration due to incident precipitation.

5.5.5.5 Institutional Evaluation. Institutional factors include requirements for federal, state, and local public health standards, regulations, guidance, advisories, ordinances, or community relations. At this time, identified institutional factors include any requirements for local building permits and/or soil/erosion control plan approval.

5.5.5.6 Cost Evaluation. Capital and operation and maintenance costs for the excavation, fill, transportation, and cover systems are estimated to be $494,000 and $19,000, respectively, for the clay cover system, and $706,000 and $19,000, respectively, for the synthetic cover system.

5.6 EXCAVATION AND OFF-SITE DISPOSAL

5.6.1 Alternative 5A - Excavation of Areas B and C, D, F, and G and Off-Site Disposal

5.6.1.1 Alternative Description. This alternative comprises the excavation of Areas B, C, D, F, and G and transport and disposal at an off-site licensed facility. Implementation of this alternative also includes excavation of approximately 100 cubic yards of sediment from the drainage ditch segment immediately east of